



## **The Use of Wireless Devices' External Storage**

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### **Field of the Invention**

This invention is the continuation of the previous invention, application number 60/401, 238 of "Concurrent Web Based Multi-task Support for Control Management System", where the claim 20 item a), b), d), claim 30 item b), and together with claim 36 represent an invention of using storage of a server system as the external storage for wireless devices. This invention focuses on how can a wireless device user actually use external storage. Specially it focus on how can a wireless device to download data to its external storage, which its principle has preliminary described in claim 19) of previous invention, application number 60/402,626 of "IP Based Distributed Virtual SAN", to transmit data in wireless environment.

### **Background Information**

#### **a) Terminology:**

##### **The Internal Storage of a System:**

The storage media such as hard disk drives, memory sticks, memory etc is connected to a system directly through bus or a few inches of cable. Therefore, the storage media actually is a component of a system in a same enclosure.

##### **The External Storage of a System:**

The storage media is not a component of a system in a same enclosure. Therefore, they has to be connected through longer cable such as Ethernet cable for IP based storage, Fiber channel cable for fiber channel storage, or wireless media etc. The storage media of external storage could be magnetic hard disk drives, solid sate disk, optical storage drives, memory card, etc. and could be in any form such as Raid, which usually consists a group of hard disk drives.

**The Storage Partition, its Volumes, and the Corresponding File System:**

To effectively use the storage system, the storage usually needs to be partitioned into small volumes. After partition, each volumes can be used to establish file systems on it. To simplify the discussion, the term of the storage volume, its corresponding file system, and the term of the partition of a storage are used without differentiation in this invention.

**CCDSVM:**

It is an abbreviation for central controlled distributed scalable virtual machine system. The CCDSVM allows a control management station to control group of systems and provide distributed services to client system in Internet, Intranet, and LAN environment.

**ISP & ASP:**

Internet service provider and application service provider.

**b) Figures:**

Fig. 1: This is the same figure as Fig. 1 of “Concurrent Web Based Multi-task Support for Control Management System” with exception of renaming console host as wireless device.

Fig. 2: This is the same figure as Fig. 1 except that it shows the more details of storage system controlled by the server. In addition, multiple wireless devices are presented.

Fig. 3: This figure shows the scheme of wireless device download contents from ISP/ASP or other web sites to the external storage of this wireless device.

Fig. 4: This is the same figure as Fig. 1 of “IP Based Distributed Virtual SAN” with exception that each IP storage server provide file system as external

storage for wireless devices instead of provide IP based virtual SAN service. Also, each host actually is a wireless device.

**c) Assumptions:**

Unless specified, the programming language, the protocols used by each software modules, and the system used described in this invention are assumed to be the same as described in previous patents submission.

In the drawing, like elements are designated by like reference numbers. Further, when a list of identical elements is present, only one element will be given the reference number.

### **Brief Description of the Invention**

Today the wireless users commonly face the problem of lack of storage capacity on their wireless devices such as cell phone or PDA, which usually limited to 256MB for PDA and much less for cell phone. To effectively solve this problem and let users own multiple GB of storage for their wireless devices as well as allow users to use GB storage for their multimedia application, the storage on a server can be used as external storage for wireless devices. This technology has been claimed in previous two patents submission by the same author. Now we can examine how does the external storage actually be used by the wireless device. We can let each server unit (3 of Fig. 2) partitions its storage system in such way that each volumes will have multi-GB in size. Therefore, each user from web-browser of any of wireless devices can exclusively be assigned and exclusively access a specific storage volume on a server unit. For example, if we need to provide each user 4GB of storage space, then a 160GB disk drive can support 40 users. A 4096GB storage system on a server unit can support 1024 user. Further, any data on the wireless device can be transmitted to assigned storage volumes on a server unit. In addition, the user on the wireless device also can download the

multimedia data from any ISP or ASP to the assigned storage volumes of a designated server unit through out-band approach (Fig. 3). Finally, the user can use their web-browser, which has functionality of invoking embedded video or music, to enjoy their stored multimedia contents.

These and other futures, aspects and advantages of the present invention will become understood with reference to the following description, appended claims, and accompanying figures where:

### **Description of the Drawings**

Fig. 1: This figure demonstrates the network connection between a wireless device and a server, where

- a) Net (2) represent a communication link, which may combined with wireless and non-wireless connection media and guarantee the communication packet can be sent/received between wireless device and the server. It is also assume that the net (2) infrastructure is built up in such way that the user from web-browser of a wireless device can access and browse any web-site on the Internet, Intranet.
- b) As described in previous patents submission, the console support software (5) on server (3) can support web-based multi-task for users on web-browser (8) of wireless device (1). Further, the user on the web-browser (8) is able to perform creating structured layered files/directory or folders, and perform data management operations such as delete, move, copy, rename for data files or folders/directories etc on the assigned storage volume of server (3).
- c) As described in previous patents submission, the other software modules (9) of wireless device (1) is also capable to send data to or receive data from other service modules (7) of server (3) via communication link (2) through suitable IP or non-IP based protocol. The data file being sent cold be a digital photo picture, a message etc..

- d) As described in previous patents submission, the console supporting software (5) of server (3) and the other software modules (9) of wireless device (1) can be implemented with any suitable languages such as C, C++, Java, etc.
- e) As described in previous patents submission, the web-browser (8) of wireless device (1) can be any suitable software, which is capable to communication with web server software (4) on server (3) or with any other web server through HTTP protocol.

Fig. 2: This figure demonstrated how does the storage of a server can be assigned to multiple wireless devices as their external storage.

- a) As described in previous patents submitting, the storage system (10) of server (3) can be partitioned into multiple volumes (11) by administration staff through web-console (13) of web console host (12).
- b) The storage system (10) of server (3) can be partitioned in such way that each wireless devices can be assigned with a volume of desired size, which can be best supported by the server for maximum number of wireless devices.
- c) As described in previous patents submitting, the storage connection media could be any kinds such as SCSI cable, IP cable, Fiber cable etc. The storage system itself could be various types.
- d) It assumes that the storage system can be accessed through IP or non-IP based network and protocols.

Fig. 3: This figure demonstrated how a user from a web-browser (8) on wireless devices(1) can download data from a known web-site (12) to his/her assigned external storage (10) of server (3). The dash-lined path (a) represents a communication channel between wireless device (1) and any remote download web-site (12), which provides the contents for web download. The dash-lined path (b) represent a communication channel between wireless devices (1) and the storage server (3). The dash-lined path (c) represents a communication channel between wireless devices (1) and the remote web-server (12), which provide download contents.

### **The Detailed Description of the Invention**

#### **1: The Use of the External Storage of the Wireless Device:**

The Fig. 2 shows a simplified diagram of the wireless devices (1 of Fig. 2) using external storage system (10 of Fig. 2) of a server (3 of Fig. 2), which will effectively resolve the storage limitation problem of wireless devices (1 of Fig. 2).

##### **- Partition storage volumes (Fig. 2)**

With this invention, the entire storage (10 of Fig. 2) on a server (3 of Fig. 2) need to be partitioned into suitable size of volumes (11 of Fig. 2) such as 4GB each, which will allow the server to serve maximum number of wireless devices (1 of Fig. 2).

With the web console support software (5 of Fig. 2) of the server (3 of Fig. 2), The task of partitioning storage can be done through web-console (13 of Fig. 2) on console host (12 of Fig. 2) by administrative staff.

In order to support such storage partition, first the console support software (5 of Fig. 2) of the server (3 of Fig. 2) must send storage information of the server (3 of Fig. 2) to the web-console (13 of Fig. 2) of console host (12 of Fig. 2). This including the storage device name, storage total size etc. Second, the administration staff on console host (12 of Fig. 2) can use web-console (13 of Fig. 2) to fill and to send the storage partition information to the console support software (5 of Fig. 2) of the server (3 of Fig. 2). The storage partition information includes the number of the partitions (volumes) and the size of each partition (volume). Third, upon receiving storage partition information from web-console (13 of Fig. 2) of console host (12 of Fig. 2), the console support software (5 of Fig. 2) of the server (3 of Fig. 2) performs the actual storage partition, which divides entire storage into multiple small volumes. Finally, for each small storage volume, a corresponding file system could be built up.

**- Assign storage volumes (Fig. 2):**

Each storage volumes with its corresponding file system (11 of Fig. 2) of the storage (10 of Fig. 2) on server (3 of Fig. 2) needs to be exclusively assigned and exported to a given specific wireless device (1 of Fig. 2) by the console support software (5 of Fig. 2) on server (3 of Fig. 2).

**- Data and storage volume management (Fig. 2)**

- 1) With the support of console support software modules (5 of Fig. 2) of the server system (3 of Fig. 2), the user on web-browser (8 of Fig. 2) of wireless device (1 of Fig. 2) can setup the folder/directory structure on the file system of his/her assigned external storage volume (11 of Fig. 2). In addition, the user on web-browser (8 of Fig. 2) of wireless device (1 of Fig. 2) can perform all data management operations such as delete, copy, move, rename etc. on that file system.

In order to support such data management on external storage (10 of Fig. 2) from web-browser (8 of Fig. 2) of the wireless device (1 of Fig. 2), first the console support software modules (5 of Fig. 2) of the server system (3 of Fig. 2) must communicate with web-browser (8 of Fig. 2) of wireless device (1 of Fig. 2). Therefore, the user from web-browser (8 of Fig. 2) of wireless device (1 of Fig. 2) can choose desired data management operations and send operation information to console support software modules (5 of Fig. 2) of the server system (3 of Fig. 2). These operations include establishing folder/directory, copying, moving, or reaming data file etc. Second, upon receiving the data management operation, the console support software modules (5 of Fig. 2) of the server system (3 of Fig. 2) actually performs these operations on the assigned file system of assigned external storage volume (11 of Fig. 2) on the server system (3 of Fig. 2).

**- Store data from wireless device into external storage (Fig. 2)**

To store the data such as digital photo pictures, or messages into the assigned file system on external storage (10 of Fig. 2) of a server (3 of Fig. 2), the other software modules (9 of Fig. 2) of wireless device (1 of Fig. 2) need to send these data to other service modules (7 of Fig. 2) of server (3 of Fig. 2) via communication link between them. Upon receiving data, the other service modules (7 of Fig. 2) of server (3 of Fig. 2) write these data to assigned file system of the assigned storage volume (11 of Fig. 2) on server (3 of Fig. 2). The protocol used between these two communication entities could be either IP or non-IP based protocol.

**- Download data from remote web server site into external storage (Fig. 3)**

If the wireless device (1 of Fig. 3) user want to download data from remote web server (12 of Fig. 3) into assigned file system (11 of Fig. 3) of the external storage (10 of Fig. 3) on server (3 of Fig. 3), the following steps are required:

- 1) The user from web-browser (8 of Fig. 3) of a specific wireless device (1 of Fig. 3) accesses a remote download web server site (12 of Fig. 3) and obtain the information for download via path (a) of Fig. 3. For example, to get a web-page, which contains the data name for download.
- 2) The other software modules (9 of Fig. 3) of a specific wireless device (1 of Fig. 3) obtains download information, which becomes available in the cached web-pages on wireless device (1 of Fig. 3) after the web-browser (8 of Fig. 3) accessing the download site (12 of Fig. 3).
- 3) The other software modules (9 of Fig. 3) of a specific wireless device (1 of Fig. 3) send the obtained download information to other service modules (7 of Fig. 3) of storage server (3 of Fig. 3) via path (b) of Fig. 3.
- 4) Upon receiving the download information from a specific wireless device (1), the other service module (7 of Fig. 3) of the storage server (3 of Fig. 3) send a web download request to download web-site (12 of Fig. 3) via path (c) of Fig. 3 based on download information obtained. It then receives the download information data from web server of download web-site (12 of Fig. 3).
- 5) Upon receiving downloaded data, the other service modules (7 of Fig. 3) of the storage server (3 of Fig. 3) write these data for the specific wireless device



(1 of Fig. 3) into the assigned file system (11 of Fig. 3) on the server (3 of Fig. 3).

- **Retrieve data from external storage of wireless device**

- 1) If a web-browser has embedded video or music functionality, the web-browser (8 of Fig. ) of a wireless device (1 of Fig. 2) can be used to retrieve and play those multimedia data file such as video or music stored in wireless device's external storage volume (10 of Fig.2), which actually located on a server (3 of Fig. 2).
- 2) If there is needs, the other software module (9 of Fig. 2) of wireless device (1 of Fig. 2) also can retrieve data file from assigned file system of the assigned storage volume (11 of Fig. 2) on server (3 of Fig. 2).

- **Support external storage for large number of wireless devices**

If we need to provide each user 2GB of storage space, then a 160GB disk drive can support 80 users. A 4096GB (4 Tera Bytes) storage system on a server unit can support 2024 user. Each server only can efficiently support a limited size of the storage system. In order to support a large number of wireless devices with external storage such as 500,000 of them, a larger number of servers are required, in this case 250 servers is required. In order to let a larger number of the server to effectively support larger number of the wireless devices, an infrastructure like CCDSVM is desirable, which has been described in previous patents submission. With CCDSVM the control management station can control larger number of storage servers to provide external storage for huge number of the wireless devices.